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ıcreasingly, particularly for imparting high atures. "Whiskers" of various metals and ss steel, columbium, tantalum, titanium, used. These are from 1 to 5 μm (39 to 197 to 1000 μm (0.0012 to 0.039 inch) in ısticity and tensile strengths up to 21 000 ɔn is the use of filaments of glass, graphite, an 0.1 mm in diameter but of any desired strengths up to 2450 MPa (350,000 psi) 20 000 MPa (60 million psi). Glass-fiber erial.

n acts as the binding material surrounding ıe mass together. Thus the surface of a resin with no filler exposed.

: dyes, which actually alter the color of the ɔugh their presence impart a desired color. elves produce attractive colors, so a dye is

l amounts to increase and control the flow : amount needed for a given resin is gov- As a rule, the amount of plasticizer is held to affect the stability of the finished prod- ng.

amounts to improve the moldability and ıe molds. Wax, stearates, and occasionally y also are held to a minimum because they

plastics as adhesives is highly developed, panded tremendously in recent years. This ı Chapter 33.

ɛ base of many ablative coating materials to provide short-time protection for low- ense heating conditions or the heating ex- ɛring the earth's atmosphere. Ablation in- igh polymers into low-molecular-weight ı char. Some of the heat absorption also ıical decomposition.

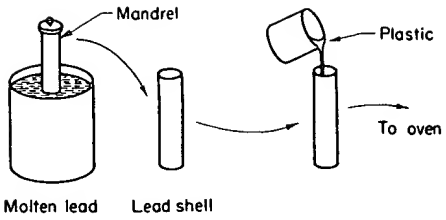

FIGURE 9-8. Steps in the casting of plastic parts.

Production processes for plastic products. Not only does the designer have a large number of plastics available from which he can select, there are a number of quite distinct processes by which a chosen plastic can be converted into a desired product. *Casting, hot-compression molding, injection molding, transfer molding, extrusion, laminating,* and *cold molding* are all used extensively. Each has certain advantages and limitations that bear on part design, material selection, and final cost, and not every plastic is suitable for each process. Because it usually is desirable to convert the material into the finished product in a single-process operation, it is important to have an understanding of the various processes so that the material-process selection will be optimal.

Casting is the simplest of the processes because no fillers are used and no pressure is involved. Of course, a mold is required. For certain simple shapes, a model of the product can be made, usually of steel, and then dipped into molten lead until a thin sheath of lead is formed over the model. The model, or mandrel, then is pulled out of the lead sheath, leaving a thin, lead mold into which the liquid plastic is poured. The resin then is cured, usually in an oven at low temperatures (65.6 to 93°C; 150 to 200°F), as indicated in Figure 9-8. After removal from the oven, the lead shell is stripped from the finished product. Some plastics, of course, can be cured at room temperatures.

Because cast plastics contain no fillers, they have a distinctive lustrous appearance. The process is inexpensive because no expensive dies or equipment are involved. However, it is limited to small objects of rather simple shape. Small radio cabinets, jewelry, and ornamental objects are commonly made by this process.

Bloumolding is used extensively for making hollow products, such as bottles and other containers. The steps in this process are illustrated in Figure 9-9.

In *hot-compression molding,* indicated schematically in Figure 9-10, granules or preformed tablets of the raw, mixed plastic material are loaded into the cavity of an open, heated mold. The plunger (male member) of the mold, usually attached to the upper portion of the press, descends, closing the mold and creating sufficient pressure to force the plastic, as it becomes fluid, into all portions of the cavity. After the material has set, or cured, the mold is opened and the part is removed. Usually, a number of cavities are contained within a single mold. The process is simple, but its use is restricted almost